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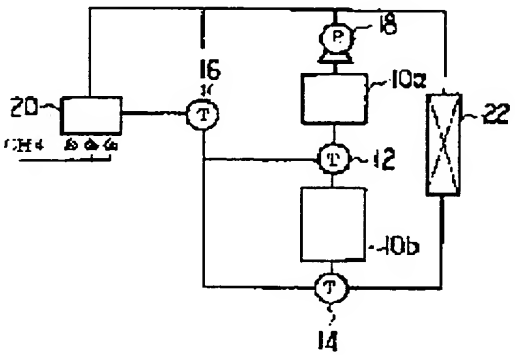
(54) FUEL CELL SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain in a short time a fuel cell system which enables promotion of warm-up t 20C o an operation temperature at the time of start-up of fuel cells and capable of stably operating.
SOLUTION: This fuel cell system has two power generating parts 10a, 10b. When temperature of the power generating parts 10a, 10b is a prescribed value or lower, a passage of circular water is switched by operating valves 12, 16 such that the circular water flows through only the power generating part 10a. In this case, a heater 20 heats the circular water to heat the power generating part 10a. Because only the power gen 20C erating part 10a is heated, a heat capacity is reduced to complete the warm-up in a short time. After the power generating part 10a is warmed up and starts power generating operation, the circular water is additionally made to flow through the power generating part 10b, by operating the valve 12, 16 to warm up the power generating part 10b. Thus, the warm-up of the fuel cell system can be completed in a short time by restricting the initial warming-up to only the power generating part 10a of the power generating parts 1AC 10a, 10b.



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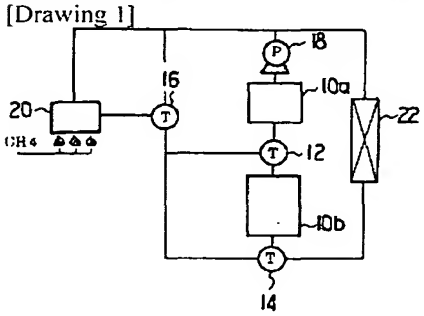
* NOTICES *

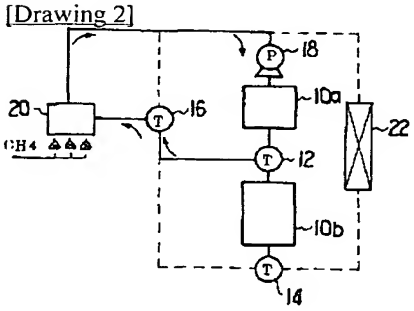
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

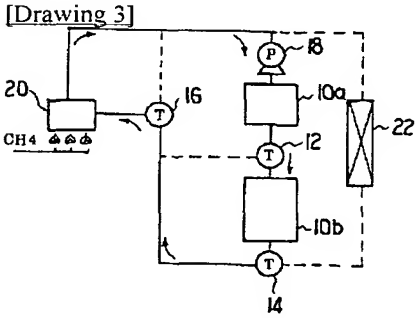
[Drawing 1]



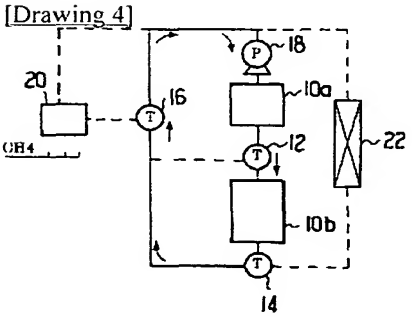
[Drawing 2]



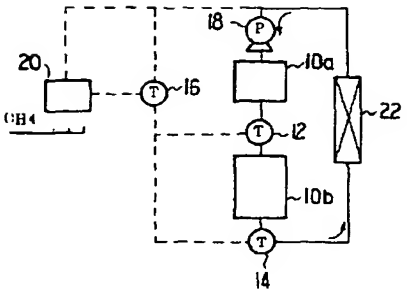
[Drawing 3]



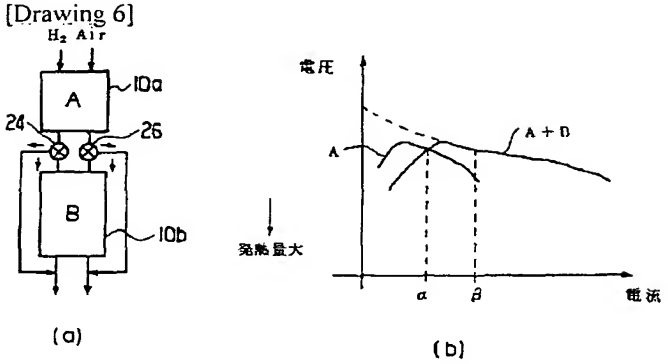
[Drawing 4]



[Drawing 5]



[Drawing 6]



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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to a fuel cell system, especially the fuel cell system which improved.
[0002]
[Description of the Prior Art] Although various kinds of fuel cells are developed, the power consumption by the side of the load which receives supply of power from this fuel cell is not always more fixed than the former. Therefore, when the capacity of a fuel cell was determined in accordance with the maximum demand power by the side of a load and the demand power of a load decreased, the generating efficiency of a fuel cell became very bad, and there was a problem that economical efficiency got worse.
[0003] Then, in order to solve this problem, the power generation section of a fuel cell is divided into a plurality, and how to control suitably the number of the power generation sections used according to the demand power by the side of a load can be considered. For example, such technique is indicated by JP,4-262370,A.
[0004]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned proior art, the method of performing warming up to which the temperature up of the fuel cell is carried out to the operating temperature at the time of starting for a short time is not indicated. When warming up to an operating temperature was not performed for a short time and reforming gas was used as fuel gas, it was influenced of CO contained in it, and there was a problem that un-arranging of the grade to which the poisoning of the electrode catalyst is carried out arose.
[0005] this invention is made in view of the above-mentioned conventional technical probrem, the purpose can promote warming up to an operating temperature at the time of starting of a fuel cell, and it is in offering the fuel cell system which can realize stable operation for a short time.
[0006]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention is the fuel cell system which enabled the change of the passage of circulating water which divides a fuel cell into two or more power generation sections, and heats and cools a fuel cell corresponding to the power generation section, and temperature of a fuel cell is characterized by changing between below a predetermined value, so that the passage of circulating water can be passed and heated among a part of power generation section.
[0007] Moreover, a fuel cell is divided into two or more power generation sections, it is the fuel cell system which enabled the change of the passage of the gas to supply corresponding to the power generation section, and temperature of a fuel cell is characterized by changing so that the calorific value of the power generation section may increase the passage of gas between below a predetermined value.
[0008] Moreover, in the above-mentioned fuel cell system, when the temperature of a fuel cell becomes beyond a predetermined value, it is characterized by changing the passage of gas so that the generating efficiency of the power generation section may become high.
[0009]
[Embodiments of the Invention] Hereafter, the gestalt (henceforth the operation gestalt) of operation of this invention is explained according to a drawing.
[0010] The block diagram of the operation gestalt 1 of the fuel cell system concerning this invention is shown in operation gestalt 1. view 1 . In drawing 1 , the fuel cell is divided into the two power generation sections 10a and 10b, and the deactivation is controlled according to the demand power by the side of a load, respectively. The passage of circulating water which heats and cools these is connected to these power generation sections 10a and 10b, and valves 12, 14, and 16 are formed so that it may become switchable corresponding to each power generation section 10a and 10b. The pump 18 is also installed in this circulating water passage, and circulating water circulates through passage with this pump 18. Moreover, all over passage, the heater 20 for heating circulating water is formed, for example, methane is burned, and circulating water is heated. Furthermore, the condensator 22 for cooling circulating water is formed in the passage of circulating water, the amount of power generation in the power generation sections 10a and 10b increases, and circulating water is cooled when calorific value increases.
[0011] Next, an operation of the fuel cell system concerning this operation gestalt shown in drawing 1 is explained. The case where the temperature of circulating water starts only one power generation section 10a in the low status below a predetermined value at the time of starting of a fuel cell is shown in drawing 2 . In this case, a valve 14 is made close, and by the valve 12 and the valve 16, passage is changed so that circulating water may circulate only through between power generation section 10a and the heaters 20. In this case, circulating water is flowing to the passage shown in

drawing 2 as the solid line, and is not flowing in the passage shown with the dashed line. Since heated circulating water flows only to power generation section 10a by this, heating of power generation section 10a can be promoted, and the temperature of power generation section 10a can be made to reach to an operating temperature for a short time. This is because the heat capacity of the power generation section which should be heated can be made small by having divided while and passing circulating water only to power generation section 10a. In addition, if power generation section 10a which passes circulating water at the beginning in the above-mentioned case is made smaller than power generation section 10b of another side, since heat capacity will also become small that much, the heating time mentioned above can be shortened more.

[0012] As mentioned above, by valves 12 and 14, although the temperature of a fuel cell passed the passage of circulating water only to one power generation section 10a between below a predetermined value and being heated, when the temperature of a fuel cell rises and a predetermined value is reached, as shown in drawing 3 , passage is changed so that circulating water may circulate to both power generation section 10a and power generation section 10b. In this case, since power generation section 10a is already in the power generation status and has become the febrile state, even if it connects circulating water to power generation section 10b of another side, it can perform warming up of power generation section 10b with a heater 20 and the heat of power generation section 10a for a short time.

[0013] If a power generation operation is started and power generation section 10b also begins to generate heat, since heating of circulating water by the heater 20 becomes unnecessary, as shown in drawing 4 , it will be changed so that it may circulate through the passage of circulating water only among the power generation sections 10a and 10b by valves 12, 14, and 16. Furthermore, since cooling of circulating water is needed when the amount of power generation in the power generation sections 10a and 10b increases and calorific value also increases, as shown in drawing 5 , it changes so that circulating water may circulate through the passage of circulating water between the power generation sections 10a and 10b and the condensator 22 by valves 12 and 14. This will be in the operational status by the full capacity of a fuel cell.

[0014] As mentioned above, in this operation gestalt, since a fuel cell is divided into two or more power generation sections 10a and 10b and only power generation section 10a is heated at the time of starting, a fuel cell can be put into operation for a short time. Moreover, since the calorific value by power generation section 10a can be used besides a heater 20 when putting power generation section 10b of another side into operation, starting of power generation section 10b can also be performed for a short time.

[0015] In addition, in this operation gestalt, although the fuel cell is divided into the two power generation sections 10a and 10b, the number of partitions is not restricted to two and can be suitably determined according to the intended use of a fuel cell, or the status of a load effect.

[0016] The fuel cell structure-of-a-system view concerning this operation gestalt is shown in operation gestalt 2. view 6 (a). The fuel cell is divided into the two power generation sections 10a and 10b in drawing 6 (a). Although the hydrogen and air which are a propellant are supplied to the two power generation sections 10a and 10b by the passage of gas, selector valves 24 and 26 are formed in the passage of this gas. The case where gas is supplied only to power generation section 10a, and the case where gas is supplied to both power generation section 10a and power generation section 10b are changed by these selector valves 24 and 26.

[0017] The relation of the voltage of the fuel cell corresponding to the current required of a fuel cell and the amount of currents is shown in drawing 6 (b). In drawing 6 (b), it is a thing when the solid line shown by A uses only power generation section 10a, and is a thing when the solid line shown by A+B uses both power generation sections 10a and 10b.

[0018] As shown in drawing 6 (b), as for the voltage, the demand current is low between parvus, and a voltage also becomes high with the increase in a current. If it passes over a still fixed peak, a voltage will also fall with the increase in a current. In this case, as for saying [that a voltage is high], the generating efficiency of a fuel cell means that it is high. Conversely, if it says, when a voltage is low, the energy of a propellant is changed into heat and it means that the calorific value in each power generation sections 10a and 10b increases. Then, when the temperature of a fuel cell is low and it carries out warming up at the time of starting, the generating efficiency of a fuel cell is low and the direction operated in the status that calorific value is large can perform warming up early. Therefore, since calorific value becomes large, the way which the current value required of a fuel cell made generate electricity to alpha of the quadrature axis of drawing 6 (b) using the two power generation sections 10a and 10b, and the current value made generate electricity only by power generation section 10a between alpha and beta of a quadrature axis can shorten warming-up time more. Thus, the temperature of a fuel cell is below a predetermined value, and while carrying out warming up, it is suitable to change the passage of gas by the selector valves 24 and 26 shown in drawing 6 (a), so that the calorific value of the power generation sections 10a and 10b may increase. Since warming up is promoted and it can reach to the usual operating temperature in a short time more by this as mentioned above, a startability can be raised.

[0019] In addition, after a warming-up end will be shown in drawing 6 (b), and it will operate in the status that a reliance voltage (generating efficiency) is high.

[0020] Although it is effective in shortening warming-up time even if it enforces independently the starting technique of the operation gestalt 1 described more than operation gestalt 3., and the operation gestalt 2, respectively, if these are combined, it can shorten warming-up time further and can improve a startability.

[0021] An explanation of the operating method of the fuel cell system concerning this operation gestalt is shown in Table 1. In addition, in Table 1, A shows power generation section 10a, and B shows power generation section 10b, respectively.

[Table 1]

冷却水温度	冷却系	燃料系
T3	通常運転	通常運転
T2	A + B	発熱量多い方
T1	A + B	A
	A	A

In this operation gestalt, operation will be changed to four phases according to a circulating water temperature. In addition, it is also good to use this if not a circulating water temperature but the temperature of a fuel cell can be measured directly in this case.
[0022] When a circulating water temperature is lower than T1 which is the 1st predetermined value, only power generation section 10a is heated, heating circulating water at a heater 20, as shown in drawing 1 . In this status, when the temperature of power generation section 10a reaches the temperature which can be generated, gas (hydrogen and air) is supplied from a propellant system, and power generation is started.
[0023] Next, when a circulating water temperature rises and it is between the 1st predetermined value T1 and the 2nd predetermined value T2, a cooling system is changed, and the passage of circulating water is connected to the two power generation sections 10a and 10b as shown in drawing 3 . However, since the temperature of power generation section 10b is considered not to go up enough in this case, a propellant system supplies gas only to power generation section 10a.

[0024] Next, since it has the temperature to which power generation section 10a and power generation section 10b can make a power generation operation perform when a circulating water temperature rises further and is between the 2nd predetermined value T2 and the 3rd predetermined value T3, the gas from a propellant system is also supplied to both power generation sections 10a and 10b. in this case -- yet -- warming up -- since it is on stream, supply of the gas to the power generation sections 10a and 10b is taken as the combination of the direction where calorific value becomes large in the case of the operation gestalt 2 shown in drawing 6 (a) and (b) Moreover, as for the status of the cooling system in this case, one between drawing 3 - view 5 of status is chosen by the circulating water temperature.
[0025] Furthermore, since the power generation sections 10a and 10b will all usually be in operational status when a circulating water temperature exceeds the 3rd predetermined value T3, a cooling system and a propellant system serve as a usual operation operation.
[0026] Warming up of a fuel cell can be more ended for a short time by combining an operation of a cooling system and a propellant system as mentioned above.
[0027]
[Effect of the Invention] Since circulating water is passed and heated among a part of power generation section which constitutes a fuel cell according to this invention when the temperature of a fuel cell is below a predetermined value as explained above, the heat capacity of the fraction into which circulating water flows can be made small, and the temperature of circulating water can be raised quickly. Consequently, warming up of the fuel cell can be carried out for a short time, and a startability can be improved.
[0028] Moreover, since the passage of gas is changed so that the amount of power generation in the power generation section may increase when the temperature of a fuel cell is below a predetermined value, internal calorific value increases and warming up is promoted. Consequently, warming up of a fuel cell can be ended for a short time, and a startability can be improved.
[0029] Moreover, since after a warming-up end changes the passage of gas so that the generating efficiency of a fuel cell may become high, it can raise the luminous efficacy of a fuel cell system.

[Translation done.]